National EPA-Tribal Science Council
Fall 2019 Face-to-Face Meeting

U.S. Environmental Protection Agency
Atlantic Coastal Environmental Sciences Division
27 Tarzwell Drive, Conference Rooms A&B
Narragansett, Rhode Island

November 13–15, 2019

MEETING SUMMARY

Wednesday, November 13, 2019

Welcome, Introductions, Roll Call and Invocation
José Zambrana, National EPA-Tribal Science Council (TSC) Agency Chair, Office of Research and Development (ORD), U.S. Environmental Protection Agency (EPA), and Neil Patterson Jr., TSC Tribal Chair, Tuscarora Nation

José Zambrana welcomed everyone to the meeting and introduced Neil Patterson Jr. as the new TSC Tribal Chair. José thanked the EPA senior leaders in attendance for their participation, Atlantic Coastal Environmental Sciences Division (ACESD) staff for their hospitality in hosting the meeting, Kristen LeBaron for her work as support contractor to the TSC, and Monica Rodia for her tremendous efforts as the TSC's Executive Secretary. He expected a productive meeting and looked forward to learning about Region 1 tribal projects and the Narragansett laboratory.

Neil explained that the Haudenosaunee people open their meetings by stating what they would like to accomplish and acknowledge the "piling of minds together." He provided the Haudenosaunee traditional opening in his native language and then explained that he had honored the Narragansett people on whose traditional lands the TSC meeting was located. The opening traditionally begins with acknowledging the people present, who have gone through a good deal of trouble to gather, and their minds may be wandering to those they left at home. Now that everyone is together, it is time to focus and work together to support the natural world and Mother Earth. The opening acknowledges the grandmother the moon, the grandfathers the thunderers, and the stars that provide guidance. The enlightened teachers are recognized, those who hold titles and leadership roles. The group has a duty to formally close the meeting before going in separate directions. The fire embers are piled up and kept glowing until the next time the group meets, and the fire is started again. It is time to get to work. Following Neil's traditional opening, the participants introduced themselves.

EPA ORD: Research Solutions for Tribes
Bruce Rodan, Associate Director for Science, ORD, EPA

Bruce Rodan began his remarks with a personal anecdote about his previous position in the White House Office of Science and Technology Policy, where he and a team worked on the issue of declining numbers of pollinators and how the team recognized that tribal input was needed to address the problem holistically. The team learned about the ethos of the land and how it is the basis of wealth. The federal government also would like to learn from tribes about sustainability.

Bruce explained that ORD's mission is to provide the science, technical support, technology and tools to inform EPA's mission to protect public health and the environment. In addition to serving as a regulatory agency, EPA is a powerhouse of global environmental research, with 12 laboratories in 11 locations, more

than 1,500 full-time equivalents (FTEs), and a $495.7 million budget. ORD provides the scientific foundation for EPA to execute its mandate to protect human health and the environment with innovative, anticipatory and multidisciplinary longer-term research; research on statutory requirements and specific environmental challenges; and technical and emergency support. ORD recently underwent a logical reorganization with three main offices and four research centers. ORD has developed Strategic Research Action Plans (StRAPs) for fiscal years (FYs) 2019–2022 for its six National Research Programs:

- Safe and Sustainable Water Resources
- Sustainable and Healthy Communities
- Human Health Risk Assessment
- Chemical Safety for Sustainability
- Air and Energy
- Homeland Security

To help inform the research priorities, ORD engaged early in the process with the TSC to determine tribal needs and identify research to help address these needs. The TSC identified tribal science needs and provided them to the six National Research Programs in the spring of 2018, and ORD engaged in preconsultation activities with tribes during the summer of 2018. The next step is to conduct tribal consultation to allow tribes to give their input on the ultimate research products and outputs of the StRAPs. The first consultation will be held during this meeting and will focus on four of the hundreds of products, allowing the Air and Energy, Chemical Safety for Sustainability, Safe and Sustainable Water Resources, and Sustainable and Healthy Communities Research Programs to obtain in-depth, targeted input on four specific products of tribal interest. Monica is the point of contact to direct tribes to appropriate contacts within the reorganized ORD.

Following the identification of the research needs, Research Area Teams developed text description details of the problem definition and potential products and outputs to ensure that the products and outputs would be beneficial and address the research needs. State scientists were included in the process, and ORD will try to include tribal scientists during the next StRAP process. ORD still is developing the language around the final products and outputs, and tribal input will help the National Research Programs refine these products and outputs before implementation. ORD works to ensure that its research products and science-based tools are useful and practical to help states and tribes address on-the-ground environmental challenges through such mechanisms as the Regional Applied Research Effort (RARE) and Regional Sustainability and Environmental Sciences research programs. Success stories from these programs can be viewed at youtu.be/nTUSIXfF3yM. ORD now funds regional, state and tribal applied work that uses citizen science and other innovative approaches through its new Innovation Projects funding mechanism. Examples of innovative ORD-tribal projects include a solutions-driven wildfire smoke pilot in Montana and an air-quality field study with the Hoopa Valley Tribe.

To help ensure that EPA research products and science-based tools are useful and accessible to needs on the ground, ORD hosts a public EPA Tools and Resources webinar series (www.epa.gov/research/epa-tools-and-resources-webinar-series) on the third Wednesday of every month to share research, demonstrate tools and seek input from partners. EPA's Research website (www.epa.gov/research) provides curated, topic-based webpages to guide the public to EPA's most current and active research, and EPA's Science Inventory website (www.epa.gov/science) provides a searchable catalog of all of EPA's published research.

Amanda Hauff commented about the communication gap that sometimes occurs between the Office of Chemical Safety Pollution and Prevention (OCSPP) and ORD and suggested that the two offices work together to enhance communication and bridge the "missing link."

Page Hingst asked how tribes can find out about ORD's research and products and then provide information that they may have. Bruce responded that Monica is the best point of contact and can help tribes to provide their input. José added that the goal is for the TSC to review the products and outputs to determine what tribal research already is taking place in Indian country so that ORD and tribal scientists can connect.

Overview of ACESD
Wayne Munns, Director, ACESD, Center for Environmental Measurement and Modeling (CEMM), ORD, EPA

Wayne Munns explained that the land on which the ACESD sits had no vegetation and a great many factories in the mid-1800s; the land still is recovering from that stress. ACESD is responsible for coastal watershed, freshwater, estuarine and coastal ecological research, including developing and evaluating methods and models about the effects of multiple anthropogenic stressors, developing methods for measuring ecological effects of pollutants, and utilizing social-ecological systems approaches to restore the coastal environment. The laboratory initially served as a national marine water quality laboratory before becoming an EPA laboratory; it focused on marine environmental toxicology and chemistry and was recognized as a vanguard of ecological risk assessment methods development. In the 1995, the laboratory's focus changed to ecological effects. Current strengths of the laboratory include landscape ecology and spatial analysis, ecological modeling, environmental economics, and integrated social-ecological systems research.

ACESD is located on 11 federally owned acres, which it shares with the National Oceanic and Atmospheric Administration, and is located near academic, state and federal laboratories with more than 600 research-associated personnel. Of ACESD's 70 FTEs, most hold graduate degrees. Approximately 50 contractors—including postdoctoral fellows, students, interns and visiting scientists—also support ACESD's mission. The division's seven buildings promote green operations. ACESD's core capabilities include wet laboratory with a unique seawater delivery system, analytical capabilities, the ability to solve current problems through its access to coastal environments, expert translation of data into useful information, and the ability to address national problems through local applications.

Wayne emphasized that ACESD's research addresses national problems with local applications and benefits, applies an integrated and transdisciplinary approach, and provides flexible strengths that evolve to meet emerging national, state, and tribal needs. ACESD provides key science services to states, tribes and communities through its unique research capabilities, expert knowledge of ecological and related issues, highly valued partnerships and key stakeholder networks, and rapidly deployable field capabilities in response to environmental emergencies.

In response to a question from Dave Jewett, Wayne explained that tribal research needs are reflected in a great deal of the research carried out by the division. ACESD also can provide technical assistance to tribes, as well as help tribes to identify the next steps in solving environmental challenges. Michael Stover added that the laboratory provides thermal modeling assistance in the St. John River Watershed, identifying warmer areas that result from deforestation and other causes, to help the Houlton Band of Maliseet Indians' approach to restoration efforts.

TSC Tribal Caucus Self-Introductions and Tribal Vignettes
TSC Tribal Representatives

TSC Tribal Representatives provided overviews of their tribes' histories, cultural stories and science needs.

Neil explained that nine Indian nations have lands within EPA Region 2, and these nine nations have high political diversity but are culturally similar. Seven of the nine are members of the Haudenosaunee Confederacy. Of these, the Onondaga Nation, Tonawanda Seneca Nation and Tuscarora Nation still maintain their original forms of government because they did not reorganize following first contact. Citizens of these nations do not consider themselves United States or New York citizens. The Great Law of Peace bound the five original nations of the Haudenosaunee Confederacy together; although nonwritten, the wampum signifying this law is effectively a constitution. The Tuscarora's primary lands lie in Virginia and North Carolina, so the nation has many science and political needs that fall outside of Region 2's responsibility. Most reservations of the Haudenosaunee Confederacy are located in New York, with some reservations located in Oklahoma and Wisconsin because of displacement.

The Two-Row Wampum Treaty is the grandmother treaty between the Haudenosaunee Confederacy and Europeans arriving in what is now the United States. It was established in 1613 and asserts that the confederacy and the Europeans would share the river of life, traveling separately in canoes and ships, respectively, and not disturbing each other. The Haudenosaunee Confederacy has a rich history of treaties that encourage friendship, peace and trust, with nine being established between the years of 1613 and 1814. This should serve as a model for any research consultations with tribes. Neil's uncle was present in Geneva, Switzerland, in 1976 during a United Nations (UN) Indigenous Peoples conference, and Neil traveled with a youth delegation to the UN Climate Change Summit in New York City in 2019.

Neil emphasized that it is important for non-Native researchers to understand the UN Declaration on the Rights of Indigenous Peoples (UNDRIP), a comprehensive statement addressing the human rights of indigenous peoples. UNDRIP emphasizes the rights of indigenous peoples to live in dignity, maintain and strengthen their own way of life, and pursue self-determination. UNDRIP comprises 46 articles, including 17 on how to protect and promote indigenous culture and five about direct participation in affecting decisions. "Research" has a negative connotation in indigenous cultures because of the history of abuse and trauma related to past research on tribes. "Free, Prior and Informed Consent" is a specific right recognized in UNDRIP, and researchers must adhere to this when partnering with tribes for research. Tribal research being undertaken in Region 2 includes biophysical (e.g., watershed protection by the Cayuga Nation, potable water and illegal dumping research by the Tuscarora Nation) and cultural. Cultural research, including language immersion, is critical for the Haudenosaunee people to understand their relationship to the environment.

Page (Region 7) showed a news video about the catastrophic flooding in her area that occurred in March 2019; deaths and bridge collapses occurred. Increased mold in homes and *Escherichia coli* in wells have been ongoing concerns since the flooding. The Santee Sioux Nation reservation comprises 116,000 acres in northeast Nebraska along the Missouri River. Although approximately 1,200 people live on the reservation, only about 300 live in the village of Santee, where the tribal offices are located. The Santee Sioux Nation Office of Environmental Protection's air concerns include indoor air quality, radon, smoke management and pollution source identification in the emissions inventory. The office's water concerns include the very high level of *E. coli* found in the area and nonpoint sources (NPS) (agriculture runoff, high nitrates). The Tribal Response Program deals with illegal dumping and littering at 22 dump sites, a decrease from 33 dump sites in 2018, and is concerned about illegal dumping, proper solid-waste disposal, underground and above-ground storage tank compliance, spill prevention, recycling, and vermicomposting and food waste. Potential research projects for the tribe include examining the connection between water impairment and illegal dump sites and exploring the possible contamination from illegal dumping. The tribe's overarching science concerns are related to enforcement, community buy-in and technical guidance.

Ted Coopwood asked Page whether the tribe had worked with or had plans to work with schools to address food waste solutions. Page responded that the tribe plans to, and a number of options are

available. Suzanne van Drunick offered to connect Page with Shannon Kenny, who is responsible for ORD's food waste program.

Billy Longfellow explained that the three distinct Passamaquoddy communities have separate governments, and the seal of the Passamaquoddy Tribe at Sipayik (Pleasant Point) underscores this distinction. Passamaquoddy refers to the people who spear pollock, and Pleasant Point is the traditional seasonal fishing village of the Passamaquoddy tribe. The Passamaquoddy people have lived in their homeland for more than 10,000 years. Currently, the Passamaquoddy Tribe, which is part of the Wabanaki Confederacy, has approximately 3,600 members. The Passamaquoddy language, an Algonquin language, has been preserved in the Passamaquoddy-Maliseet dictionary. The Passamaquoddy at Sipayik community experiences extreme tides on its lands. The Sipayik Environmental Department manages air quality, water quality and Brownfields programs and also employs a GIS/multimedia specialist and environmental scientist. Science needs include drinking water science, fishery science, native species and habitat restoration science, remote water sensors, and climate science. The tribe is developing a climate adaptation plan. Coastal erosion is also of concern because the community lives at sea level, and with current sea-level rise predictions, many of the houses on the reservation will be under water. The word Sipayik translates to "at the end" because of the tribe's location at the end of the land, and erosion is occurring at an exponentially rapid rate.

David Charters asked Billy what monitors that the tribe is using to link to remote sensing technologies. Billy responded that he is exploring multiparameter probes, such as YSI or HOBO. Telemetry is too expensive, so the probes would need to be field-checked.

Michael informed Billy that EPA and the U.S. Army Corps of Engineers are helping to address erosion issues and offered his assistance in connecting his tribe to the appropriate points of contact.

José asked Billy what is included in the tribe's climate adaptation plan. Billy replied that erosion, extreme events, flooding, fisheries, ocean acidification and disaster preparedness had been included in the plan.

Katie Tiger described the Eastern Band of Cherokee Indians (EBCI) Natural Resources Department and how staff are working to incorporate Cherokee culture into its management strategy. Cherokee homelands historically encompassed a large region in the southeastern United States; at the pinnacle of the tribe's geopolitical power, the area covered 400,000 square miles in eight states. Abundant and diverse natural resources supported a vibrant culture for the Cherokee people for centuries. The biodiversity of the region has been intricately interwoven with the Cherokee identity for millennia and continues to provide cultural, economic and ecosystem services to the current tribal community. Clean water and aquatic wildlife serve subsistence, artistic, medicinal, recreational and aesthetic purposes. For example, the slime from eels was used to make stickball players slippery so that they would be harder to tackle, and river cane is used for basketry. Conserving the existence of and access to these critical resources in a diminished land base presents a tremendous challenge.

The current EBCI land base is approximately 57,000 acres, with 9,000 tribal members living on tribal lands. Many of the headwater streams originate on National Park Service lands, and 85 percent of EBCI lands are forested, between 2,000 and 5,000 feet elevation. Cherokee watersheds include 180 miles of flowing streams and rivers. Maintaining the ecological integrity of what remains for the Cherokee people is crucial to preserve cultural identity. Meeting these conservation objectives requires both a modern scientific approach and a respect for the sound foundation of traditional knowledge that tribal members have passed down for centuries. In 2015, the EBCI Natural Resources Department began a holistic integration of its fisheries, wildlife and environmental programs.

In January 2015, EPA approved the tribe's request to administer a federally approved water quality standards program under the Clean Water Act (CWA), and in 2018, EPA finalized federal approval of

EBCI water quality standards and use designations: ceremonial, source drinking water protection, recreation and cold-water habitat. EBCI aquatic systems face anthropogenic threats from habitat loss and fragmentation, urbanization, pollution, invasive species, disease, over-exploitation and climate change. The tribe has undertaken restoration efforts for the sicklefin redhorse fish. Cherokee traditional ecological knowledge (TEK) about the relationship of water quality and salamanders (e.g., eastern hellbender) is being invigorated. The Cherokee language is in a state of emergency; department staff have initiated a partnership with the Cherokee language consortium to either identify existing names or develop previously undescribed names for salamander families, genera and species. Cherokee is a descriptive language, and staff work to integrate natural history and traditional knowledge to sustain the language and integrate it into community learning opportunities and cultural events, such as a traditional fish weir re-enactment, the tribal schools' Earth Day Island Discovery event, and "Kids in the Creek" stream snorkeling. The department approaches conservation through an adaptive management framework where social and cultural decisions by community members and leadership within and outside of the boundary result in conservation strategies. Katie concluded her vignette with pictures of the tribe's mobile air monitoring SUV, painted with a sunset over the Cherokee's mountains.

Alexis Wagner (Region 10—Alaska) explained that the Metlakatla Indian Community is located far south in Alaska, so the reduced amount of snow affects cedar growth and hydropower projects. Alexis works with the community's GAP (General Assistance Program) and solid-waste programs to clean up the nearby landfill. Since September, a pilot project with the local school system has collected more than a ton of food waste, which is donated to a local garden for composting. The community would like to initiate a recycling program, but it is difficult to get waste out of Alaska for recycling. Salmon restoration will begin in 2020, and water quality testing has occurred near an old U.S. Coast Guard site. The community developed a climate adaptation plan and did its best to include the native language because only five fluent speakers are alive currently and TEK is intertwined with the language. Because of its location, the Metlakatla Indian Community works more closely with the Pacific Northwest states than with Alaska.

Neil closed the session by commenting that many tribal environmental department staff must "wear multiple hats" and perform a wide variety of duties, but common themes connect tribal and non-Native environmental scientists.

Passamaquoddy Tribe at Pleasant Point Sipayik Environmental Department Water Quality Programs
Billy Longfellow, TSC Region 1 Tribal Representative, Passamaquoddy at Sipayik (Pleasant Point)

Billy explained that the Passamaquoddy at Sipayik's Environmental Department runs four water quality programs: EPA CWA Section 106, EPA CWA Section 319, EPA Environmental Justice Small Grant, and Bureau of Indian Affairs (BIA) Water Resources. CWA Section 106 calls for the protection and restoration of waters to ensure safe drinking water and healthy aquatic ecosystems. The Sipayik CWA 106 Program is used to protect the tribe's drinking water source through a watershed-based plan that protects traditional and tribally owned lands and waters from all sources of impairment or degradation. The goals of the Sipayik CWA 106 Program are to manage water quality using a regulatory framework based on the CWA structure, address water quality problems on a watershed basis through nonregulatory means, help to provide safe and clean water for consumption and all other water-related activities, and develop baseline data that track the quality of all tribal waters and wetlands. Through CWA 106, the Sipayik Environmental Department actively monitors water quality in the Boyden Lake Watershed because this is the source of the tribe's drinking water. The tribe also monitors the lower St. Croix River Watershed because the St. Croix River is the traditional river of the Passamaquoddy, and the watershed contains an abundance of the current reservation and trust and fee lands. The Sipayik Environmental Department is undertaking alewife restoration efforts and studies in this watershed. The Sipayik CWA 106 Program allows cultural survival of the tribe in providing safe and clean water for

tribal members, improves Passamaquoddy access to environmental data and information, and makes the public aware of and encourages community participation in addressing tribal environmental issues.

The purpose of EPA CWA Section 319 is to prevent or reduce NPS pollution, protect and restore watersheds and aquatic ecosystems, promote sustainable and livable communities, and protect human health. The goals of the Sipayik CWA 319 Program are to implement a watershed-based plan on the St. Croix River Watershed, set baseline data for NPS pollution sites, implement best management practices for NPS-impaired sites, provide NPS training for water quality staff, and educate tribal members and others about NPS pollution. Virtually all of the wetlands and watershed areas on the Pleasant Point reservation are affected by NPS pollution, including the Boyden Lake Watershed. Little River receives runoff from the reservation, which has the potential to affect wildlife species that depend on the river's ecosystems and tribal lifeways. The tribe has updated its CWA 319 management plan to protect the St. Croix River and culturally important water bodies from NPS pollution and implement an antidegradation policy in the St. Croix River Watershed. Current NPS pollution concerns include hydromodification, roads, forestry, camps and urban runoff.

EPA's Environmental Justice Small Grants Program supports communities working on solutions to local environmental and public health issues. Members of the Pleasant Point community have a severe distrust of the drinking water as a result of the history of drinking water violations by the local water district. The tribe is using its Environmental Justice Small Grant to conduct drinking water quality studies at multiple homes on the reservation that are linked into the local water district, increase community awareness and involvement in local drinking water issues, install a water purification station that is accessible for the community to use, and create a community action plan with community member input and guidance after data have been collected and presented to community members.

The Sipayik Environmental Department uses its BIA Water Resources assistance to monitor the effects on surface and groundwater from the Passamaquoddy Wild Blueberry Company to ensure that the Machias River Watershed, which is Atlantic salmon habitat, is not negatively affected. The specific goals are to take measurements of water quality parameters that are electronically logged at timed intervals, continue monitoring well transducers that take well-depth measurements and temperature readings, scrutinize the U.S. Geological Survey (USGS) stream gauge, and continuously monitor the effects of irrigation on surface and groundwaters. Past monitoring has allowed the Passamaquoddy Wild Blueberry Company to develop compliance plans that allow the tribe to continue to use irrigation waters from nearby brooks; failure to comply would have a severe negative impact on blueberry production. BIA Water Resources assistance allows the tribe to enhance data for decision-making, create a three-dimensional map of wells and water use, and allow water-use decisions to be more proactive than reactive.

A participant asked how long the community has mistrusted the drinking water. Billy responded that the mistrust has been in place for decades. The local water district does not provide a good source of water, and many other good water sources are available but not in use.

In response to a question, Billy explained that pesticides are used on the blueberry crops.

Michael asked which locations are being targeted to improve salmon habitat. Billy replied that the tribe's historical focus is on alewives, which have decreased from a population of 2 million to 200,000; at one point, there were fewer than 1,000. Salmon is a new focus because all species must be considered. The dams, tanneries and sawmills have blocked salmon's river access, and the tribe is trying to restore as much of this habitat as possible so that the salmon return.

Suzanne asked how many river miles would be restored following the removal of the Milltown Dam. Billy responded that 15 to 18 miles of the St. Croix River would be restored.

Lon Kissinger asked whether stream temperatures affect alewives. Billy explained that the largest impact was barriers in the rivers. Lon asked about stream temperature increases resulting from climate change. Billy responded that this is a greater concern for salmon. Lon asked whether streams near the tribe support migrating salmon populations. Billy replied that historically, the rivers supported salmon populations, but the salmon fisheries collapsed a long time ago. Some organizations have begun salmon restoration efforts, but this will require a great deal of science and climate knowledge. The main climate issue for the tribe is temperature.

Neil commented that the first dam licensed by the Federal Energy Regulatory Commission to be decommissioned was the Hogansburg Dam in upstate New York in 2016. Hundreds of river miles were re-opened. He offered his tribe's expertise to Billy's tribe. He asked whether glass eels were present in Passamaquoddy waters; Billy responded that the glass eel fishery is healthy.

Beth Jackson asked whether the tribe was examining macroinvertebrates. Billy replied that past research had focused on macroinvertebrates, but none had been performed during the last 6 years. Future research may be planned.

Wayne asked which pollutants were found in shellfish. Billy explained that the tribe had seen an increase in fecal coliforms and harmful algal bloom (HAB) "red tide" events.

Development of a Phylogenetic Database of Atlantic Salmon in the St. John River/Wolastoq Watershed
Cara O'Donnell, Water Resources Specialist, Houlton Band of Maliseet Indians

Cara O'Donnell explained that Wolastoq, meaning "beautiful flowing river," is the Maliseet name for the St. John River. The Maliseet community in the United States with the Maliseet First Nation communities in Canada call themselves Wolastoqiyik, "people of the beautiful flowing river." Atlantic salmon are culturally significant to these communities. The Meduxnekeag River Watershed lies within the St. John River Watershed, which is the largest watershed east of the Mississippi River. The Meduxnekeag River does not have enough salmon to support restoration

The tribe has planned a study of the 20 largest tributaries of the St. John River to develop a phylogenetic database of Atlantic salmon in these tributaries to assist in its restoration efforts. The project has been funded as a RARE project, and the Maliseet have partnered with several organizations, receiving technical assistance from a number of government and nongovernmental organizations. Phylogeny is the study of the evolutionary development and diversification of taxonomic groups from one another over time using genetics. Genomics is used to distinguish the adaptive differences between populations, which are exhibited in genetic markers; behavioral and physiological characteristics can be distinguished by these genetic markers. The tribe will use the phylogenetic data to determine the best traits to restore salmon in the Meduxnekeag River and plans to share the data with other tribes and entities to help them restore salmon to their areas, as many groups have ongoing salmon conservation efforts.

For conservation purposes, the genetic relatedness of Atlantic salmon is broken down into management units called distinct population segments. Only the Gulf of Maine supports wild population segments. The St. John River distinct population segment is not listed as endangered, but the Canadian government is attempting to list the salmon as endangered in Canadian waters.

In addition to high ocean mortality of Atlantic salmon resulting from climate change, predation and changing ocean ecology, a large hydropower structure was built on the St. John River in 1969 that blocked access to many of the tributaries. A hatchery was established in 1970 to mitigate the effects of the dam, but the hatchery did not account for genetic differences, breeding without regard to the salmon's natal stream, phylogeny or genetics. One research question is whether the St. John River fish are

genetically homogenous and to what degree the salmon have retained genetics unique to their origins. If they are genetically distinct, this must be reflected in future conservation strategies.

The tribe, with a great amount of technical assistance, used electrofishing methods in the 20 tributaries to gather data. Given the extremely low density of the salmon and the large area to cover, data gathering was very time-consuming. Field work to collect tissue samples began in the spring of 2019 using a fyke net. Because only one fish was caught in 3 weeks, future sampling will use a smolt net or wheel. At least 30 samples per tributary are needed to have a statistically valid sample size. The tribe needs to collect additional samples from 10 tributaries to reach this amount, and the goal is to finish sampling in 2020.

In addition to continuing sample collection and data analysis, a hatchery is being built that will include space for Meduxnekeag River species. The tribe has performed considerable amounts of preparation and work to provide a healthy habitat for Atlantic salmon, including water quality monitoring and improvement and gasoline remediation. The ultimate goal is the restoration of all native anadromous species, including eel and alewives. Eel is an important cultural species for the Maliseet.

Neil asked about the opportunities and challenges of cross-border cooperation. Cara responded that Michael would address this in his presentation.

Salmon Fish Tissue Collection, DNA Extraction and Genomics Study of the Wolastoq Watershed
Michael Stover, Indian Program Manager, Region 1, EPA

The Houlton Band of Maliseet Indians requested EPA's support to help identify the appropriate genetic strain of Atlantic salmon native to the Meduxnekeag River. The results can be used in support of future enhancement of current Atlantic salmon populations in the watershed and reintroduction of Atlantic salmon in tributaries that are absent of salmon. The effort has been a cross-boundary restoration collaboration with six First Nations and six federal agencies on both sides of the border. A statement of cooperation was put in place among the collaborators. In addition to support from the RARE research program, EPA's regional laboratory in Chelmsford, Massachusetts, contributed supplies and equipment for the collection effort. Partners include EPA Region 1 and ORD, the Houlton Band of Maliseet Indians, the Maliseet Nation Conservation Council, Fisheries and Oceans Canada, the National Oceanic and Atmospheric Administration, the U.S. Fish and Wildlife Service, and the Maine Division of Marine Resources.

As part of the RARE project, the tribe is obtaining DNA extraction products from tissue samples of smolt, parr and returning-adult Atlantic salmon and using microsatellite analysis and single nucleotide polymorphism (SNP) markers to develop a population-diversity database of various strains of salmon DNA correlating to specific tributaries in the watershed. The results can serve as tools for measuring and monitoring salmon diversity within the tributaries, will further the understanding of the evolutionary history and diversity of the Wolastoq salmon population, and will enhance the certainty of stocking programs to maintain integrity and diversity within the watershed. Genetic diversity is critical for the survival of natural populations of species, increases survivability in random events (e.g., drought, flooding, disease outbreaks), and allows species to avoid inbreeding depression.

DNA has been extracted from six tissue samples collected from salmon parr in a tributary of the Meduxnekeag River. Approximately 2,000 samples will be collected from smolt, parr and adults in the summers of 2019 and 2020 in 20 tributaries in the Wolastoq Watershed. In January 2020, the EPA laboratory in Cincinnati, Ohio, will conduct genetic sequencing work. The project partners will collaborate on the findings and interpretation of the results of the microsatellite analysis and SNP markers. Microsatellites are tracts of repeated tandem DNA that serve as highly variable neutral genetic markers; the study will utilize 18 microsatellite markers published by Fisheries and Oceans Canada. SNPs

are regions of mitochondrial and/or nuclear DNA that differ by one base pair and act as markers of genetic variation.

Next steps are to develop tributary-specific live gene banking; develop a captive rearing program for tributaries; eventually release eggs, juvenile and/or smolt in tributaries, such as the Meduxnekeag River; and support future Atlantic salmon stocking efforts for the entire Wolastoq watershed. EPA and the tribe would like to engage in discussions about the potential fish passage that will be instituted around a dam run by the territorial government of New Brunswick, Canada. Michael summarized that establishing a phylogenetic database will better inform decisions on egg placement and captive rearing, and proposed work will further the restoration goals of the collaboration. Finally, the collected genetic information will add to the current knowledge database of Atlantic salmon.

In response to a participant question, Cara explained that eDNA was used to collect samples during the preliminary 2018 assessment of the Meduxnekeag River. The use of eDNA is limited because it only detects 24-hour levels in rivers, and it cannot be used in the fall because of the presence of leaves, and fall is the desired time to use it. The eDNA did detect presence on the Canadian side and below headwaters where salmon have been land-locked in the past.

Lon asked whether the tribe was concerned that, without the previous selection pressure that had been present before the dam was installed, it would see a decay in genetic diversity. Michael responded that hatchery staff are more educated than in the past and now use cross-breeding techniques that do not stifle genetic diversity. The hope is that the tribe will see that the genetic diversity has been maintained, and salmon populations can be restored. Cara added that Fisheries and Oceans Canada has indicated that even though only single-digit numbers of adults return to the Meduxnekeag River, those salmon will have the expected genetics. Wayne noted that genetic drift could account for genetic differences among subpopulations in the watershed, and that population recovery and viability might simply be a matter too few adult salmon returning to spawn. A participant added that also exacerbating genetic introgression is that the mechanism of cross-breeding farm- and hatchery-raised fish is not well understood. Next-generation sequencing will allow researchers to look at more than a few alleles. The genetics of hatchery- and farm-raised fish will be compared to wild fish and may determine whether the issue is genetic drift or polluting by less diverse species.

Narragansett Laboratory Tour

TSC members and meeting participants toured the facility and were provided overviews and highlights of ACESD's experimental greenhouse, PFAS [per- and polyfluoroalkyl substances] Analytical Laboratory, Nutrients Analytical Laboratory, Wet Laboratory, Microplastics Laboratory and field-sampling capabilities.

The meeting was recessed at 4:30 p.m.

Thursday, November 14, 2019

Building Collaborations With EPA Research Expertise to Address Tribal Science Challenges

Neil commented on the need for the TSC, particularly Tribal Representatives, to learn about and see EPA's research to make connections and bring tools and methods back to their regions and tribes. He shared that it has been very useful hearing EPA's research presentations during the tour, and it makes him think about how tribes can perform research to help their communities. The TSC selected three research topics of tribal interest being carried out at the Narragansett laboratory so that the members could learn more about them and potentially forge collaborations.

Topic: Contaminants of Emerging Concerns: PFAS and Microplastics
Introduction: Page Hingst, TSC Tribal Vice Chair, Santee Sioux Nation of Nebraska
Presentations: Mark Cantwell and Michaela Cashman, ACESD, CEMM, ORD

Page introduced the topic of PFAS by noting that she could not locate any articles about PFAS in Indian country on Google Scholar. Many PFAS articles were published in the 1990s, and she is curious about the gap between these studies and its recognition as an "emerging contaminant" 20 years later. Bruce explained that EPA worked with industry in the 1990s to facilitate the removal of two chains found in perfluorinated compounds, which they thought addressed the issues. Industry developed additional PFAS compounds that had fascinating characteristics and were thought to be less toxic. With the multitude of PFAS compounds in use, standards are needed to test them, and technologies are needed to identify them. New technology development led to the discovery in 2013 that these compounds are more ubiquitous than was previously known, which led to the current state of "playing catchup." Jeff Frithsen added that ORD research addresses a wide variety of tribal environmental concerns, but the research may not be performed within the context of tribes; this often is true outside of ORD and why Page may not have found PFAS articles specific to Indian country, although the research could be applied to tribal concerns. Amanda noted that EPA's PFAS action plan and collaboration with EPA-Tribal Partnership Groups will allow the Agency to focus on this issue in Indian country; tribal research needs to be included as part of the baseline. José commented that the TSC is working on how to bring indigenous knowledge and TEK into discussions, such as unique tribal exposure scenarios. Ted added that EPA must determine how to communicate to families about the practical actions that decrease exposure without increasing alarm. Bruce explained that EPA's Duluth, Minnesota, laboratory is performing ecological risk assessment related to PFAS, and he will ensure that the message includes tribes.

<u>PFAS Research at ACESD</u>

Mark Cantwell noted the steep learning curve in measuring PFAS in the environment. As of 2018, the National Institute of Environmental Health Sciences had identified more than 4,700 PFAS compounds in the environment. Although U.S. companies are phasing out these compounds, other countries still produce them. PFAS compounds are ubiquitous in many product categories (e.g., textiles, cosmetics, food packaging) and directly enter groundwater. Offshore and onshore birds have been found to have different PFAS composition profiles. PFAS compounds are present globally in humans, animals and the environment and are persistent and bioaccumulative. Many PFAS compounds cause reproductive, developmental and immunological effects. These effects are more problematic in aquatic systems because of direct and dietary exposure.

ACESD's PFAS research has been responsive to EPA and partner needs, spanning three of EPA's national research programs—Safe and Sustainable Water Resources, Sustainable and Healthy Communities, and Chemical Safety for Sustainability—and addressing needs informed by EPA's and ORD's PFAS action plans and program office needs. ACESD has provided scientific support for PFAS issues as directed in the EPA PFAS action plan. ACESD's StRAP research products for FYs 2019–2022 are aimed at using analytical methods to obtain a better understanding of the total PFAS burden.

Mark summarized that the research products of three EPA national research programs directly address ecological research identified in EPA and ORD actions plans and by program offices. ACESD's chemistry, wet laboratory and field capabilities provide unique resources to assess the PFAS-associated ecological effects and support regions, states and tribes. The multidisciplinary team approach integrates exposure and ecological effects research from initiation through implementation to interpretation, and ACESD will continue to provide scientific and technical support to the states, tribes and local communities. The division's enthusiastic staff are motivated to conduct and deliver effective research products.

Contaminants of Emerging Concern: Microplastics

Michaela Cashman explained that 8 million tons of plastic are expected to enter the ocean annually, and floating plastics account for only 1 percent of these expected plastics in oceans. The remaining plastics end up in sediments and break down into smaller plastic fragments as a result of a series of biological, chemical and physical weathering processes. Microplastics are plastic fragments or fibers that are less than 5 millimeters in size. Isolating microplastics from sediment is essential for quantification and identification, and procedural differences among the numerous published isolation methods prevent meaningful comparisons of data. This lack of standardization also prevents the ability to identify highly polluted areas and determine environmental toxicity. Some reported ecological effects include reduction in feeding activity and reproductive fitness, oxidative stress, geno- and neurotoxicity, and growth delay.

ACESD participates in a RARE project collaboration with Regions 1, 2, 3 and 9 to assess current methods for the extraction and isolation of microplastics from different types of sediment and conduct a multiregional survey of microplastics in estuarine and marine sediments. Michaela displayed data showing the method comparison by polymer, noting that there is no "one-size-fits-all" method for all types of polymers or sediments; results depend on the sediment matrix and microplastic size. Field samples have been collected and Raman analysis performed on samples spiked with the microplastic internal standard and on samples for microplastic quantification. ACESD will develop drinking water methods for microplastics by the fall of 2020 for the Safe and Sustainable Water Resources Research Program, build capacity in EPA laboratories and standardize methods for micro- and nanoplastic identification and quantification, and examine the cellular and metabolomic effects of nanoplastic exposure on bivalve, meiofaunal and bacterial communities.

In response to a question from Melissa McCullough, Michaela explained that meiofauna are benthic invertebrates smaller than 500 microns in size.

In response to a question from Bruce, Michaela explained that the researchers explored methods that were realistic, highly published and easily replicated; that generated small amounts of hazardous waste; and that had reasonable processing times. The hybrid method is similar to methods with these characteristics in terms of its density separation technique, but the researchers learned very early that methods that work for coarse sand do not work as well for sediments high in organic material. The researchers modified some of the density separation methods and found that they yielded much higher results for local sediments.

Jeff asked whether the National Institute for Standards and Technology (NIST) has applicable standards, and if the researchers used these standards. Michaela responded that NIST is trying to develop a microplastics standard, but because researchers' needs vary, it is difficult to develop one standard. ACESD uses its own suite of standards that it developed, but no national standard exists currently.

Jeff asked about the threshold ACESD is using in terms of its nanoplastic research. Michaela explained that her research threshold is 40 microns, but the new Raman analyzer has a threshold of 1 micron. The laboratory partners with the University of Connecticut on nanoplastic exposure research.

Topic: Sustaining Culturally Significant Fish and Wildlife Habitats
Introduction: Neil Patterson Jr., TSC Tribal Chair, Tuscarora Nation
Presentations: Brenda Rashleigh and Naomi Detenbeck, ACESD, CEMM, ORD

Neil explained that he has been working on this topic in the context of Superfund work, and Natives and non-Natives have different opinions regarding the meaning of habitat restoration. Biologists discuss ecological keystone species, and recent discussions have included cultural keystone species—species that are necessary for the continuation of a culture and around which societies have built their cultures.

Existing knowledge within indigenous communities clearly identifies the cultural keystone species. These keystone species may differ among tribes, but tribes have similar notions of duties and responsibilities around their specific species. Humans must provide justice for and fulfill their responsibilities to wildlife. All species on Mother Earth have rights, and humans must support these rights.

Sustaining Culturally Significant Fish and Wildlife With Climate Change and Habitat Alteration

Naomi Detenbeck explained that because habitat variables are critical to fish population persistence, models are needed that assess existing habitat extent and inform conservation and restoration actions to protect and improve critical fish habitat. ACESD had the opportunity to work with the Houlton Band of Maliseet Indians in support of the Wolastoq International Collaboration agreement for aquatic habitat improvements. Researchers had previously developed a predictive model of New England stream and river temperatures and flows and found predictors of median July/August stream and river temperature. The models were used to map out the current thermal regime based on land cover and median July air temperature and also to examine riparian restoration and loss scenarios. ACESD worked with the Maliseet to improve the modeling and address gaps.

The Meduxnekeag River Watershed is a 1,336-square-kilometer (516-square-mile) watershed that flows through the Houlton Band's tribal land. The Houlton Band of Maliseet Indians' goals for the project were to determine the locations of existing cold-water refuges and select areas for riparian restoration. The overall goal is to expand brook trout habitat and restore native Atlantic salmon populations. The scientific objectives were to develop a fine-resolution stream-temperature prediction model for the Meduxnekeag subwatershed, apply a new method to fill in monitoring gaps, evaluate alternative predictor values, and predict the thermal regime distribution across the watershed.

The researchers began with the parameters in the New England model, performed a backward step-wise regression, substituted parameters, added interaction terms and selected the spatial autocorrelation terms. The researchers identified the important variables for the monthly and growing season models, which provide management opportunities. Naomi displayed maps of the July and growing season thermal regime distributions in wet and dry years to illustrate the potential restoration scenarios. The project identified the potential for improved high-accuracy stream temperature models, even crossing international boundaries, as well as the potential for restoring thermal regimes through improvement of stream shading, flow regimes and stream morphometry. Critical cold-water refuge areas also were identified.

Lon asked how effective modifications to improve riparian habitat will be as temperatures increase. Naomi responded that ACESD has been funded by Region 10 to examine climate change and the potential for riparian zone restoration in the Pacific Northwest to preserve or improve critical cold-water refuge areas for salmonids and other cold-water species. The researchers found that, in the lower Columbia River, climate change projections can moderate some of the increase in temperature but not all. Air temperatures cannot be addressed without addressing climate change, but hydrologic regimes are important, so maintaining base flow in a system is a much better buffer against changes in air temperature.

Jeff asked how difficult it would be to apply the model to a different geographical area. Naomi responded that the U.S. Forest Service has been exploring models for the western portion of the United States. The USGS has published a high-resolution National Hydrography Dataset, which covers most of the country. The most considerable effort would be cleanup of the flow network. Jeff commented that models are good at showing that targeted restoration efforts can provide positive results ("payback"), so that models can be used in a resource-management context. With support from Region 10, Naomi currently is trying to improve the U.S. Forest Service models with the improved shade variables for the Pacific Northwest. Alaska's data lag behind the continental United States.

Simulation of Metacommunities of Riverine Fish (SMURF)

Brenda Rashleigh explained that SMURF is a spatial fish community model that is responsive to human activities. Fish in rivers provide benefits—including cultural benefits—and move in river networks, with multiple species interacting, and human activities affect fish. The approach is to use a structured population model for each species and river segment. The Habitat Suitability Index is used as a multiplier on the survival rates. The model outputs provide understanding of limiting factors in various areas. For example, Chinook salmon are limited by different factors in different areas of the watershed (i.e., temperature in the lower network, discharge in lower gradient tributaries, and slope in headwaters). Tribes can use the model to assess the relative value of habitat restoration activities to the recovery of salmon and other fish species; prioritize the locations of protection, recovery and restoration efforts; and evaluate the importance of thermal refuges.

Page asked whether the SMURF model could be used to help tribes develop climate adaptation plans. Brenda responded that the model that Naomi described could be used in tandem with SMURF to examine future scenarios and understand how the temperature will change and how those changes will affect future populations.

Neil asked what types of discharges were used in the model. Brenda responded that "discharge" referred to river flow. Neil commented that tribes are increasing the amount of large woody debris in streams and asked whether this was considered in the model, particularly for brook trout. Brenda explained that Joe Ebersole has examined this for some of the western streams as part of the Habitat Suitability Index, which determines the most suitable amount (percent) of woody debris in the stream.

Lon asked whether the researchers had examined dam breaching. Naomi responded that this was included in some of the Pacific Northwest work following dam removal. The analysis still is in progress. Brenda added that in the SMURF model, movement is a function of distance, and the dam can be represented as a long-distance segment, reducing the probability of fish moving past it.

Suzanne asked whether the researchers have collaborated with the USGS Water Science Centers, noting that this is an opportunity for interagency cooperation. Naomi responded that the researchers obtain data from many sources, and USGS data are an important component of the work. USGS has good predictive models for peak flows, and Naomi was able to improve the low-flow models.

Chris Taylor asked whether these models could be linked with other data or models (e.g., nutrient) to examine the fish habitats more holistically. Brenda replied that she has considered linking SMURF to the Soil and Water Assessment Tool (commonly known as SWAT) and economic valuation models.

Neil noted that shifting baselines present a challenge for models. He asked whether it is possible to use zooarchaeology or local harvest records to determine reference conditions and historical productivity of the watersheds. Brenda responded that historical data are available for freshwater mussels, but fish surveys are relatively recent in history.

José asked how the tribe provided input for the project. Cara responded that the Maliseet provided temperature data, identified data gaps and collected data to address the gaps. The tribe will use the results to implement best management practices. They will combine Naomi's data with their knowledge of the locations of critical habitat.

Topic: HABs
Introduction: Neil Patterson Jr., TSC Tribal Chair, Tuscarora Nation
Presentation: Betty Kreakie, ACESD, CEMM, ORD

Neil noted that HAB occurrences have increased in the news in recent years.

HABs: Responding to State, Regional and Tribal Needs

Betty Kreakie gave the presentation in Darryl Keith's absence. Excess nitrogen and phosphorous from air, land and water decrease the quality of fresh and estuarine waters. These excess nutrients can come from agriculture, wastewater, atmospheric deposition and other sources. HABs have the potential to generate adverse health, ecosystem and economic effects, including beach closures and declines in fish populations. HABs secrete different types of toxins, many of which exert toxic effects on the liver and nervous system. Humans and wildlife can be exposed through ingestion and body contact during recreational activities. During the 2017 bloom season, EPA was aware of blooms, beach closures and/or health advisories in 27 states and the District of Columbia; blooms have occurred in all 50 states. Bloom season postings—which include blooms, cautions, warnings, public health advisories and closings as a result of the presence of algae, toxins or both—in 2018 indicated a longer bloom season than in past years.

The goal of the CyAN mobile application is to use satellite data to predict the water quality of a water body. It is a free, user-friendly tool that examines satellite data records to show the concentrations of cyanobacteria in lakes across the United States. It is available for use on Android devices, but not iOS ones. It currently is being developed as a web-based app, which will be compatible with most devices. The Narragansett laboratory provides technical assistance to states and tribes in utilizing satellite remote sensing, improving prediction and modeling, and monitoring lakes and reservoirs. The ultimate goal of monitoring and remote sensing is to combine satellite, buoy-deployed sensors and in-water sampling data for pigments, nutrients, toxins, microbial species, water quality and weather to develop better guidance for beach closure decisions, bloom-peak and toxin-production forecasts, and human- and animal-illness response. Betty described case studies in Utah and Oregon in which CyAN augmented state monitoring and ensured public health and safety. The EPA laboratory in Cincinnati, Ohio, also is working on analytical methods for cyanotoxins (e.g., microcystins, nodularins, cylindrospermopsin, anatoxin-a) in drinking and ambient waters.

David asked about the variation in warnings, as states do not use the same warning thresholds. Betty responded that New York and New Jersey base their warnings on visual criteria, whereas other states use cell counts or toxin concentration levels.

Dawn Taylor asked whether the laboratory is working on red tides in saltwater. Betty responded that the Region 1 work is in freshwater.

Jeff asked how close researchers are to developing an easy, reliable test for cyanotoxins. Betty replied that a quick field method for testing microcystin exists, but feedback has been that it is not reliable. An easy, reliable test for cyanotoxins is a long way off. Suzanne added that this is a complex issue because not all blooms release toxins.

Ted commented on the lack of advisories in some areas with contamination (e.g., Gary, Indiana); the effectiveness of communication to tribes and communities needs to be improved. Lon added that the Superfund Program shifted its views about the effectiveness of fish consumption advisories after it examined the risk perception of various ethnic groups. Follow-up after an advisory is issued must occur. Effective communication requires complex work.

Computation Ecology and Open Science: Research to Help Manage Cyanobacteria in Lakes

Betty stated that HAB occurrences are becoming more frequent and affect public health and water resources. Because it is difficult to define what constitutes a "bloom," the uncertainty surrounding HABs is a challenge. The goal of building models to predict blooms and bloom indicators is to combine field data and modeled data with knowledge of cyanobacteria to create predictive models of the probability of bloom events. EPA uses a variety of ecological (e.g., EPA's National Lakes Assessment) and modeled (e.g., U.S. Department of Agriculture's PRISM) datasets.

Betty showed a conditional probability plot that uses chlorophyll-A as proxy data—which is possible because of chlorophyll-A's close correlation with microcystin—to show the probability of exceeding various microcystin health advisory levels. Researchers use this relationship to explore the environmental drivers of water quality in the United States and have found that total nitrogen and total phosphorus are driving water quality in U.S. lakes. These modeling data are publicly available through GitHub. Researchers predicted the classifications spatially to identify a clear spatial pattern in lakes across the country. Trophic state and nutrient information can be used to predict when microcystin will be present.

The researchers also have been performing high-frequency spatial and temporal sampling in three different ponds in Rhode Island. The dynamics of the three ponds are very different from each other, and each pond has different conditions between years, despite the nutrients remaining constant. Reviewing 25 years of water-quality change in Rhode Island lakes and ponds indicates that water temperature and chlorophyll-A are rising. The next step is to develop a lake photic zone temperature model for all U.S. lakes; backcasting to 1981 is possible.

Cara asked about HABs in the pond that researchers considered "ideal." Betty responded that the pond used to bloom approximately 10 years ago, but it has not had a bloom since an illegal shellfish operation was removed.

Bryan Hubbell indicated that the Air and Energy Research Program has projects related to improving predictions of atmospheric deposition of nitrogen; the air-surface exchange is a source of nitrogen. He asked whether the relationship between water temperature and chlorophyll-A is dependent on nitrogen and phosphorus levels. Betty explained that this relationship has not been examined yet, but she expects that is the case.

Suzanne asked whether iron is included in the modeling of the lake trophic state. Betty responded that iron data are not collected in the National Lake Assessment, and therefore iron is not included in the model.

Jeff asked whether the modeling had indicated that nutrient management would solve the issue of HABs. Betty replied that nutrient management most likely is not the best practice to manage HABs.

Lessons Learned: Wildfire Smoke Guide and Risk Communication for PFAS and HABs
Lisa Matthews, ORD State Liaison, ORD, EPA

Lisa Matthews explained that EPA works with its state peers in environmental protection and public health through a memorandum of agreement signed by EPA, the Environmental Council of the States (ECOS), and the Association of State and Territorial Health Officials (ASTHO) in April 2016. The purpose of the agreement is to advance cooperative initiatives pertaining to environmental protection and public and environmental health.

EPA revised *Wildfire Smoke: A Guide for Public Officials* (Wildfire Smoke Guide) in 2019; earlier versions were published in 2002, 2008 and 2016 by various academic, state and federal groups. Key

questions addressed in the guide include whose health is most affected by wildfire smoke, how to reduce smoke exposure, what public health actions are recommended, and how best to communicate air quality to the public. ORD partnered with ASTHO and ECOS to review and provide comments to revisions of the Wildfire Smoke Guide, and EPA's Office of Air and Radiation partnered with air organizations, including the National Tribal Air Association (NTAA), for review and comments. The updated guide provides guidance to help communities prepare for, respond to and recover from wildfires and protect public health from smoke and ash. The new version incorporates recent research about the health effects from wildfire smoke and includes recommendations for indoor air cleaners, as well as stand-alone fact sheets.

Risk communication has been identified as a critical need, so it has become a key focus, particularly for emerging contaminants, such as PFAS. Following EPA's 2016 PFAS drinking water health advisories, there was interest in additional guidance around risk communication, including information on how different states approach PFAS and HABs risk-communication challenges. ORD worked with ASTHO and ECOS to conceptualize a risk communication project focused on two waterborne contaminants: PFAS and HABs. ASTHO and ECOS interviewed health and environmental staff from 13 states on their risk communication strategies and lessons learned for PFAS contamination or HABs advisories, which resulted in the publication of brief case studies that outline the states' overall efforts. Webinars were offered to communicate key findings.

Common risk communications themes were identified. Health and environmental officials need clear, regular, honest language that builds a level of trust between government officials and affected communities. Public education is needed regarding the assortment of quantitative values meant to convey acceptable levels of exposure to emerging contaminants. Multi-agency coordination is important. It is necessary to be consistent and comprehensive when communicating with the public. Using lessons learned from case studies, ASTHO and ECOS developed a set of helpful tools, materials, resources and strategies for PFAS risk communication, which can be found at www.ecos.org/pfas-risk-communications-hub and www.astho.org/PFAS.

Bryan commented that a new online course, in conjunction with the Wildfire Smoke Guide, is available for physicians to help patients at a specific risk for wildfire smoke exposure. Ted added that Region 9 held a meeting about wildfire smoke exposure in spring of 2019 with the Pediatric Environmental Health Specialty Units.

David asked whether there are acceptable levels of smoke or whether no level is acceptable. Bryan responded that some burns, such as pre-burns, are needed. The key is to recognize that certain conditions are better for burning to reduce the negative effects of exposure. Current research examines repeated exposures to small doses of smoke compared to a large dose from one smoke event. Other research examines the effects of wildfire events that cross the urban threshold and begin burning structures. Alexis added that the Metlakatla Indian Community used open burning methods but has supplemented this approach with a burn box to decrease emissions. Many Alaska Native Villages are instituting burn boxes.

Lon asked how to communicate risk in the face of uncertainty. Lisa responded that it is important to be clear about what is known and not known, what information is available, and what research is ongoing. An EPA-wide risk communication workgroup will be exploring these issues. Neil emphasized the importance of using a cultural context when communicating risk. Advisories that affect tribes should be coproduced with the affected tribes.

TSC and EPA-Tribal Partnership Group Collaboration Opportunities

Tribal Waste and Response (TWAR) Steering Committee and TSC Potential Collaboration on Overlapping Opportunities
Page Hingst, TSC Tribal Vice Chair and TWAR Steering Committee Member, Santee Sioux Nation of Nebraska

Page explained that she started on the TSC and TWAR at the same time and had noticed that the two groups have overlapping priorities. Both groups would like to increase their collaboration with other EPA-Tribal Partnership Groups. TWAR sponsors a meeting of the EPA-Tribal Partnership Groups at the annual Tribal Lands and Environment Forum and has decided to focus its collaboration with individual groups. Some of the common priorities may take years to address, and TWAR would like to work with the TSC on how to best move forward. The list of identified common priorities was provided in the participants' meeting materials. The TSC decided to invite the TWAR Chair to meet with a TSC subgroup that includes José, Neil, Page and David. Melissa added that the Sustainable and Healthy Communities Research Program could provide assistance.

Tribal-U.S. EPA Collaborations to Advance Chemical Risk Evaluations in the United States
Amanda Hauff, Tribal Program Manager, OCSPP, EPA, and José Zambrana, TSC Agency Chair, ORD, EPA

Amanda explained that the TSC, National Tribal Toxics Council (NTTC) and Tribal Pesticide Program Council (TPPC) work together with OCSPP and ORD on chemical risk evaluations. OCSPP implements the Federal Insecticide, Fungicide and Rodenticide Act; Federal Food, Drug and Cosmetic Act; Toxics Substance Control Act (TSCA); and Pollution Prevention Act. The office also oversees the NTTC and TPPC. The TPPC is an EPA-Tribal Partnership Group that comprises representatives from more than 30 tribes; it serves as a tribal technical resource, assists tribes in building tribal pesticide programs, and facilitates the communication of tribes and tribal organizations with EPA. The NTTC provides tribes with greater input on issues related to pollution prevention and toxic chemicals and also provides advice to EPA on chemical risk assessment, management and pollution prevention programs that may affect tribes.

Tribes are highly affected by environmental toxicants, and tribal sovereignty and treaty rights are of paramount concern to them. The report, *Understanding Tribal Exposure to Toxics*, was delivered by the NTTC to EPA Administrator Gina McCarthy in 2015 and EPA Administrator Scott Pruitt in 2018. The document requested that EPA institutionalize a process to consider tribal exposures in risk assessments. The recommended first step is to identify the state of toxics affecting tribes. TSCA, the primary chemicals-management law in the United States, requires EPA to evaluate existing chemicals using risk-based chemical assessments and providing increased public transparency for chemical information. The purpose of risk evaluation is to determine whether a chemical substance presents an unreasonable environmental or public health risk, including for susceptible subpopulations. EPA must evaluate hazard and exposure, use scientific information and approaches, and ensure that decisions are based on science. For environmental exposures, tribes may represent a susceptible subpopulation, as described by TSCA.

The NTTC, TPPC, TSC, OCSPP and ORD are working together to better understand potential tribal exposure scenarios and data that would inform chemical risk evaluations. The collaboration has examined hexabromocyclododecane in depth as part of a pilot effort focusing on exposures from fish consumption, open dumping and open burning of waste. The working conceptual model of tribal exposure scenarios takes into account tribal lifeways—which are critical and not anachronistic—and geographic, economic and technological characteristics. Examples of tribal risks and concerns include untreated water for ceremonies, drinking or bathing; traditional diets; and the number of activities that take place outdoors or use outdoor resources. Tribes are primarily highly exposed because of the higher exposures to the natural

environment. For example, tribal partners have requested risk evaluations to consider exposure from fish consumption.

The next steps for the collaboration are to identify chemicals planned for risk evaluation on which to collaborate, as well as how discuss how to find and generate data, inform risk evaluations performed by external organizations, and advance broader understanding of tribal risks and exposures.

Lon commented that he has done a great deal of work with the NTTC in the area of risk evaluation to expand on fish consumption advisories in the Pacific Northwest, and it is well-verified that traditional fish consumption is significantly higher than what is stated in EPA guidelines. Surveys also have identified the historic fish consumption rates, and in Alaska the vast majority of the indigenous population practices subsistence living. The treaties and promises that the United States government made to tribes cannot be empty.

Karen Gude asked about extrapolating consumption rates for national guidelines. Amanda responded that this would require engaging in policy conversations and considering tribal historical consumption rates. Lon added that exposure varies geographically, so it is difficult to develop national guidelines. David commented that increasing prescriptiveness leads to decreased protection. Communication is key, not standards setting.

Jeff commented that the TSCA revision has resulted in a series of remarkable deadlines, and the new process provides the opportunity for tribal input. EPA will provide scoping documents that include exposure scenarios for the next 20 high-priority chemicals sometime during the spring of 2020; tribal input on these exposure scenarios is particularly important. These scoping documents must reflect tribal concerns. Amanda agreed and provided an overview of how her office responded to the first list of 10 high-priority chemicals, which included a 25-page document that describes the importance of tribal lifeways (e.g., fish consumption).

Tim Kent noted that the Quapaw Tribe of Oklahoma was one of the first tribes to develop tribal-use scenarios that were incorporated into human health risk assessments performed at a Superfund site. Barbara Harper of Oregon State University is highly knowledgeable in this area, and Tim recommended using her as a resource. She determined the Quapaw consumption rate and what it would have been without avoidance of the Superfund site. The ultimate goal is to return the land to pre-mining conditions and return to traditional lifeways.

Bryan asked whether changes in exposure based on how food and materials are prepared are being considered. Amanda explained that this is included in the various exposure pathways. Lon added that risk assessors have tried to consider tribal risks at every major contaminated site and actively use tribal exposure information to assess risks. The quandary is how to determine plausible future fish consumption rates; tribal treaty rights must be considered.

ORD Research Tribal Consultation

Monica opened the formal tribal consultation by explaining the format of the consultation and taking a roll of those present, including tribal leaders or their representatives.

Bryan presented about one potential research product from the Air and Energy Research Program to better understand the effectiveness of air cleaning filtration systems in wildfire smoke conditions. The research will include field studies of indoor and outdoor air quality during smoke events with complementary laboratory studies of the effectiveness of portable air cleaners. The program will partner with the Missoula City-County Health Department, Climate Smart Missoula, the University of Montana

and the Hoopa Valley Tribe. Bryan asked the tribal members to consider the following questions to provide feedback about this product:

1. What are the best ways for ORD and the tribe to communicate the results of the studies to reach the audience at highest risk who would benefit the most?
2. What is most effective in enabling tribal members to reduce their smoke exposures during wildfire events?
3. Are there additional considerations that your community faces in reducing smoke exposure in the indoor environment that the research program should know about as it moves forward with this research project?

In response to Question 2, a telephone participant asked whether there would be a system in which the city would be able to able to obtain respirators or air-conditioning filters. Bryan responded that EPA recommends wearing N95 respiratory masks during smoke events. EPA's Wildfire Smoke Guide and fact sheets provide information about when to use a respiratory mask, and EPA has a course focused on the recommendations on how to use N95 masks. The research program plans to test a number of filters and develop guidance on which types of filters may be used.

In response to Question 3, Neil commented that woodstove smoke is an indoor smoke exposure source. He noted that the tribes in his area do not have a great deal of exposure to wildfire smoke and asked whether the consultation would be open to tribal input related to energy. Indigenous peoples face injustices related to energy development in the United States; more affluent communities can develop renewable energy sources, but tribes are left behind. The bigger picture is thinking about how heat and electricity are intertwined. Why is the research program focusing on wildfires? Bryan responded that he had presented about only one of many research topics that the program plans to investigate. One entire section of the research portfolio examines energy and energy alternatives. He welcomes additional feedback on those products. One product is focused on alternatives to traditional heating (e.g., pellet stoves that drastically reduce emissions), and another product summarizes the past 5 years of work on the cookstove issue, which includes collaborative efforts with tribes. Bryan would like any feedback about energy systems that are of interest to tribes.

Jeremy Pitka asked about what would be available to remote Alaska Native Villages following an influx of wildfire smoke. Because of their remote locations, these villages cannot receive immediate shipments of equipment following an event. Bryan responded that EPA's Wildfire Smoke Guide has planning resources. Alaska Native Villages can identify large gathering areas and proactively install filters in these locations; a stockpile of N95 masks can be amassed, as well.

Page noted that this research focuses on local efforts and asked about research on lingering and remote affects. Bryan responded that the research program is undertaking a great deal of work on how plumes move and how to predict which areas will be affected following an event. EPA is concerned about this issue and how the lingering effects of wildfire smoke can affect populations a great distance from the original event. Bruce emphasized that the research programs selected examples of research of tribal interest to highlight during this tribal consultation because a 1.5-hour consultation is not enough to present about the hundreds of products that the six research programs are considering implementing. Tribal members are welcome to provide comments about any of the proposed products.

Jeff explained that the Chemical Safety for Sustainability Research Program's long-term visions are to provide the information needed to inform EPA and stakeholder decisions about chemicals, accelerate the pace of chemical assessment and decision-making, replace or reduce vertebrate animal testing, and provide scientific innovation and leadership to transform chemical screening and assessment. The research program would like feedback on the potential research output of migrating legacy dashboards

(e.g., ToxCast, CPCar, ACToR) to the CompTox Chemicals Dashboard and discontinuing the legacy dashboards. The CompTox Chemicals Dashboard would be a freely accessible website and integration hub that would include more than 875,000 chemicals, more than 700,000 toxicity data points, and millions of symptoms and identifiers, among other data points and information of interest. Jeff asked the tribal members to consider the following questions to provide feedback about this product:

- Does the CompTox Chemicals Dashboard provide chemical information needed to inform tribal concerns about chemicals? If not, what information is missing?
- Is the online CompTox Chemicals Dashboard easy to navigate? Can you find the information needed? What suggestions might you have to improve navigation?
- Are there other chemical databases that the program should consider for integration with the CompTox Chemicals Dashboard?

Neil asked whether the ability exists to geographically tag chemicals to learn about their places of production or locations where they are found. Jeff responded that the program has tried to provide information about concentrations in the environment, but this is a difficult task. The National Aquatic Resource Surveys examine a select list of chemicals in the aquatic environment and might be able to provide limited location information. Geotagging chemicals is a great idea, but the capability is not there yet. Bruce added that a PFAS map exists. Jeff was unsure whether geographical information is built into the Toxics Release Inventory, but EPA's Office of Land and Emergency Management manages a database with some geolocation information. Dianne Barton supported the request for geospatial tagging.

Dianne asked whether information about volume and information from chemical data reporting would be included, which would allow individuals to see trends. Jeff was unsure whether this information had been included, noting that it would need to be derived from the Office of Pollution Prevention and Toxics TSCA Program. He will look into this suggestion.

Suzanne explained that the Safe and Sustainable Water Resources Research Program is seeking tribal input regarding this particular output because the program discussed it with the National Tribal Water Council (NTWC) and it covers three areas of tribal interest—water treatment, HABs and watersheds. Christopher Impellitteri described the output as resources and tools for characterizing and mitigating lead in drinking water distribution systems and premise plumbing. The potential product of the output would be treatment strategies for reducing lead and copper in drinking water.

Christopher asked the tribal members to consider the following questions to provide feedback about this product:

- Are there unique issues regarding lead and copper in drinking water for tribal communities that ORD or the research program should consider for its research?
- What are the most effective ways to communicate research results to enable tribal members to apply these results for reducing the risk of exposure to lead and copper in drinking water?
- Do tribal data or information exist on lead and copper that would support this work?

Shaun Livermore asked whether changes in flow rates, which can affect corrosion and the release of lead, would be included in the research. Christopher responded that this aspect is a component of the research, including how flow rate change influences microbial release. The implications of water conservation measures can change the distribution regime of a whole building or distribution system. The research also examines how changes in flow affect water quality.

Shaun asked whether the research would investigate the life expectancy of valves when using different anticorrosion technologies. Christopher replied that this was not currently planned but could be added. ORD has produced a fact sheet that helps individuals identify lead-free products.

Tim asked whether the results of this project eventually would be integrated into the Lead and Copper Rule. Suzanne responded that the rule is handled by the policy side of EPA, and she cannot speak to that. Bruce added that TSCA research has been incorporated into the current consideration of the Lead and Copper Rule. This research does not focus on items included in the Lead and Copper Rule, but future research could be directed in this area. Karen added that the rule is under a public comment period through the end of the year.

Melissa explained that she would like to obtain feedback to be able to tailor outputs of the Sustainable and Healthy Communities Research Program for tribal use. The specific product that she is presenting for input during this consultation is the Environmental Quality Index (EQI), including the development of census-tract, community, rural and tribal versions of the EQI. Examining the cumulative health impacts for vulnerable groups will help to discern impact factors by exploring interactions between conditions in the holistic or total environment (natural, chemical and social components) and health and well-being, including how these may change over time. The information will be accessible through mappable data sets for the EQI, recommendations for ways to include rural and tribal measures into EPA's EJSCREEN mapping tool, and a report on demonstrated associations between EQI and health. Tribal input is vital because tribes may have different sources and types of data, as well as different cultural needs and values compared to other communities. The research program would like to partner with tribes interested in developing an EQI that would benefit their specific needs. Melissa asked the tribal members to consider the following questions:

- What are the health conditions of greatest concern for tribal members, especially those where disparities exist? How do location, life stage and other factors seem to affect the conditions and the disparities?
- How can tribal engagement happen with this project in a way that the unique issues and qualities of individual tribes are considered while developing aspects of the research and product that can be widely or generally applicable across tribes?
- What other input (e.g., environmental or other data, cultural priorities, factors affecting well-being) is useful for making this product best meet your needs?

Dianne asked how the researchers would obtain data to demonstrate associations between the EQI and health outcomes. Melissa responded that obtaining census-tract data is difficult, which is why the EQI project began with county-level data. Health data is also difficult to obtain, because of HIPAA privacy rules. A national examination is not possible, but researchers can compare the holistic EQI characterizations to the health data that is available for certain locations (e.g., for preterm birth by looking at birth records and for mortality by looking at death records). Local health databases can provide a way to begin to make comparisons when we have the EQI data at comparable geographic scales.

Those who would like to use email to submit comments about any of ORD's proposed research outputs may send them to Michael Slimak, National Program Director of the Sustainable and Healthy Communities Research Program, at ordresearch@epa.gov using "Tribal Comment" in the subject line. Written comments and feedback in response to the charge questions may be submitted to Monica Rodia no later than December 31, 2019, at the following address:

Monica Rodia
Senior Indian Program Manager

U.S. EPA Office of Research and Development
Office of Science Advisor, Policy and Engagement (MC 8104R)
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Research Mixer

Participants learned, in an informal setting, about ACESD research projects and tools that can address tribal concerns. ACESD staff provided demonstrations of the Water Management Optimization Support Tool (known as WMOST), of the Strengthening Resiliency in Coastal Watersheds by Protecting Ecosystem Services web-based GIS decision-support system, and how CyanoScope can be used to perform citizen-science monitoring of HAB occurrences.

Narragansett laboratory staff also presented the following posters:

- Determining Seagrass Abundance in Southern New England Waters Using High-Resolution Landsat 8 Imagery
- Predictive Seagrass Habitat Model
- Modeling Habitat Associations at Multiple Scales for the Common Loon
- Landscape Stressors of the Narragansett Bay Ecosystem
- Watershed Management Optimization Support Tool (WMOST) v. 2: Integrated Water Management for Communities and Planning Authorities
- Estuaries Matter: Connecting Recreation and Sense of Place to Resilience on Cape Cod
- Wading Through the Data: Exploring Relationships Between Human Perceptions and Biophysical Water Quality in Coastal Waters
- Developing a Roadmap for Solutions-Driven Research: Collaborating With Stakeholders and Partners in the Design, Implementation and Translation of Nonpoint Source Nutrients Research
- Pharmaceuticals and Wastewater Tracers Along the Lower Hudson River
- Temporal Trends of PFAS in an Urbanized Estuary in the Northeastern United States
- Estuarine Fate of Aqueous Film Forming Foam Applied in an Urbanized Watershed
- Microplastics in Marine Sediments—A Comparison of Current Extraction and Isolation Methods

The meeting was recessed at 5:00 p.m.

Friday, November 15, 2019

TSC Discussion Items

Amanda provided an update on the lead curriculum, *Lead Awareness in Indian Country: Keeping our Children Healthy!* OCSPP worked with the TSC, NTTC and ORD to develop a five-module curriculum focused on outreach about lead. Pilot events have been held at the Oneida Nation in Wisconsin, Shoshone-Bannock Tribes in Idaho, Eight Northern Indian Pueblos Council in New Mexico, and 2019 Tribal Lands and Environment Forum in California. More than 200 tribal members participated in the process. The next step is to revise the curriculum based on the feedback received from these tribal members and send the updated curriculum to the TSC Tribal Caucus and NTTC for final comments. The goal is to publish the curriculum in early 2020, along with videos and instructor materials. The curriculum will contain everything that tribes need to implement it in their communities.

Ted asked Amanda how difficult she expected the final EPA review to be. Amanda responded that she included all Assistant Administrators, Regional Tribal Operations Committees (RTOCs) and EPA-Tribal Partnership Groups in each step, and all of them have had a chance to review the curriculum. The EPA

Administrator is excited about the curriculum and is expecting it for review. Therefore, she does not expect the curriculum to be held up in a lengthy review process.

Beth explained that EPA had sought tribal input for its vision for citizen science during two webinars held in October. The *Citizen Science Handbook: Quality Assurance and Documentation*, known as the Citizen Science Handbook, has been released. Francine St. Denis added that EPA's Office of Inspector General had indicated that EPA should become involved with citizen science, so the vision statement addresses what actions that EPA needs to take as an agency and through partnerships with states and tribes to be able to use data generated by citizen science for decision-making. Comments from tribes about the vision were due that day, and EPA will begin to incorporate them. Beth added that the E-Enterprise Leadership Council is a shared governance structure designed to streamline activities and enhance technology. EPA, states and tribes are represented on the council. The E-Enterprise Leadership Council is interested in learning about citizen science projects that tribes are undertaking and in obtaining tribal input on community versus citizen science. Various groups have different terms for citizen science (e.g., volunteer science) because the term "citizen" raises concern for them.

José noted that the second ORD tribal consultation will take place on December 11, 2019, from 3:00 to 4:30 p.m. EST. Tribes can provide input about outputs and products proposed by the Air and Energy, Chemical Safety for Sustainability, Safe and Sustainable Water Resources, and Sustainable and Healthy Communities Research Programs.

José explained that the Society for Environmental Toxicology and Chemistry's (SETAC) Indigenous Knowledge and Values Working Group supported a symposium at the SETAC North American Meeting the previous week. The *Western Research Methods and Indigenous Knowledge: Collaborative Approaches Towards Environmental Quality and Integrity* session included a presentation on the TSC collaboration on tribal exposure scenarios and two presentations on ORD-supported tribal projects. Amanda stated presenting tribal work in an international forum is cutting edge, and she encouraged the TSC and Tribal Representatives to continue to seek international platforms to educate others on what tribes want and need. José added that he would like to plan a full-day session at a future SETAC or other meeting and see EPA support tribal researchers to present in other sessions. Wayne, Amanda and Page volunteered to help José explore these possibilities.

The Caucuses were given two charges to address during the Caucus sessions:

- Identify the locations of the two 2020 face-to-face meetings, one in Indian country, and one at an EPA facility. Of the 11 EPA laboratory locations, the TSC has recently visited four, two are under major renovations, and one is a regional laboratory with very little ORD presence. The remaining options are: Newport, Oregon (watershed/estuary science focus); Ada, Oklahoma (groundwater focus); Duluth, Minnesota (Great Lakes focus); and Chapel Hill, North Carolina (environmental exposure on human health focus).

- Determine the best framework for the TSC's work. The TSC receives requests to prioritize tribal science needs, but with 573 unique federally recognized tribes and their government-to-government relationships with EPA, it is challenging to identify overarching needs. Policy priorities are different than science needs, and not part of the TSC's purview. Many science needs exist, and some are similar across regions and tribes, whereas some are specific to individual tribes. Are the previous TSC high-level priorities (climate change and TEK) still relevant to pursue? A potential framework to address the question of priorities is to identify a high-level priority and then break it down into key challenges and key needs, which will allow the TSC to collaboratively address science needs to support tribes and allow EPA to honor its Tribal Trust Responsibility.

José presented the themes identified during the November 2017 face-to-face meeting in Phoenix, Arizona: (1) bolstering communication and networking, (2) featuring tribal science and tribal work, (3) EPA serving as a resource, (4) collecting feedback on lead curriculum modules, and (5) identifying key science needs for tribes. The TSC has accomplished these items. Potential future activities for the TSC include working with other EPA-Tribal Partnership Groups, finding opportunities to work with tribal youth on STEM projects, and exploring and addressing data defensibility issues. In terms of collaborating with other EPA-Tribal Partnership Groups, the TSC will continue to work with the NTTC and TPPC on exposure scenarios and the lead curriculum, as well as initiate a workgroup with TWAR to address common priorities. The TSC could pursue partnerships with the NTWC and/or NTAA or wait until the right opportunities present themselves.

Caucus Sections

The Tribal and EPA Caucuses met separately to discuss individual Caucus business.

Caucus Report-Outs

José reported that the EPA Caucus had discussed matching EPA resources and staff with tribal science needs while being clear about the expected accomplishments and goals of the partnerships. TSC collaborations with other EPA-Tribal Partnership Groups should continue. EPA Representatives are grappling with how to be helpful in terms of quality assurance and data defensibility to support tribal work so that data are useful to tribes and also could be used by EPA or in court.

Page explained that the Tribal Caucus had chosen the location of the Spring 2020 TSC Face-to-Face Meeting to be held at the EPA facility in Chapel Hill, North Carolina, and the location of the Fall 2020 TSC Face-to-Face Meeting to be hosted by Katie's tribe in North Carolina. The Tribal Representatives would like to see more tribal representation during TSC meetings, particularly during face-to-face meetings. The Tribal Caucus also discussed building tribal research capacity and how to incorporate knowledge gained at TSC meetings into regional and tribal work. The Tribal Air Monitoring Support Center provides a good model for dissemination. The Tribal Caucus would like two Caucus Sessions to be held at each face-to-face meeting, one near the beginning of the meeting and one at the end. It also would be helpful to develop SMART (specific, measurable, achievable, relevant, time-bound) goals for Tribal Representatives to bring to their RTOCs.

TSC Business Session

Monica presented Dave with a plaque to thank him for his service as the prior TSC Agency Chair and his subsequent service as the ORD Representative. Dave was the first Co-Chair to serve under the new system in which her office selects the Agency Co-Chair from a pool of ORD candidates. He was instrumental in connecting the TSC with the National Program Directors, as well as ensuring that the TSC visited ORD laboratories to make connections between EPA and tribal scientists. Dave thanked everyone for the value that they added to his ORD experience and encouraged the TSC to move forward and "strike while the iron is hot."

Closing and Adjournment

Kacee Deener was impressed with the incredible experience and learned a great deal at this very productive, informative meeting. She thanked everyone for their time and energy in creating a sound agenda and being so present during the discussions.

Maggie LaVay also was impressed and made notes about opportunities on which her office can follow up. She would like to ensure that ORD products are responsive to the needs of tribes.

Wayne expressed his gratitude for being able to host the group, stating that it was the most personally group experience he had had in his many years at the Narragansett laboratory.

Lisa is looking forward to building connections with the TSC.

Alexis provided the closing blessing and concluded by saying “Let’s go!” in her native language.

The meeting was adjourned at 11:21 a.m.

National EPA-Tribal Science Council (TSC) Fall 2019 Face-to-Face Meeting Participants

Neil Patterson, Jr.
TSC Tribal Co-Chair
Tuscarora Nation (Region 2)

Page Hingst
TSC Tribal Vice Chair
Santee Sioux Nation of Nebraska (Region 7)

José Zambrana
TSC Agency Co-Chair
U.S. Environmental Protection Agency
Office of Research and Development

Valerie Blank (via teleconference)
U.S. Environmental Protection Agency
Office of Research and Development
Office of Science Advisor, Policy and Engagement

Mark Cantwell
U.S. Environmental Protection Agency
Office of Research and Development

Michaela Cashman
U.S. Environmental Protection Agency
Office of Research and Development

David Charters
U.S. Environmental Protection Agency
Office of Land and Emergency Management

Ted Coopwood
U.S. Environmental Protection Agency
Office of Children's Health Protection

Kacee Deener
U.S. Environmental Protection Agency
Office of Research and Development
Office of Science Advisor, Policy and Engagement

Naomi Detenbeck
U.S. Environmental Protection Agency
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Suzanne van Drunick
U.S. Environmental Protection Agency
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Megan Fleming
U.S. Environmental Protection Agency
Office of Research and Development

Jeff Frithsen
U.S. Environmental Protection Agency
Office of Research and Development

Karen Gude
U.S. Environmental Protection Agency
Office of Water

Amanda Hauff
U.S. Environmental Protection Agency
Office of Chemical Safety and Pollution Prevention

Bryan Hubbell
U.S. Environmental Protection Agency
Office of Research and Development

Elizabeth (Beth) Jackson
U.S. Environmental Protection Agency
Office of Environmental Information

Dave Jewett
U.S. Environmental Protection Agency
Office of Research and Development

Tim Kent
Quapaw Tribe of Oklahoma (Region 6)

Lon Kissinger
U.S. Environmental Protection Agency
Region 10

Maggie LaVay
U.S. Environmental Protection Agency
Office of Research and Development
Office of Science Advisor, Policy and Engagement

Billy Longfellow
Passamaquoddy Tribe at Sipayak (Region 1)

Lisa Matthews
U.S. Environmental Protection Agency
Office of Research and Development

Melissa McCullough
U.S. Environmental Protection Agency
Office of Research and Development

Wayne Munns
U.S. Environmental Protection Agency
Office of Research and Development

Cara O'Donnell
Houlton Band of Maliseet Indians

Alexa Olson
U.S. Environmental Protection Agency
Region 6

Mindy Pensak
U.S. Environmental Protection Agency
Region 2

Regina Poeske
U.S. Environmental Protection Agency
Region 3

Brenda Rashleigh
U.S. Environmental Protection Agency
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Bruce Rodan
U.S. Environmental Protection Agency
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Monica Rodia
TSC Executive Secretary
U.S. Environmental Protection Agency
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Office of Science Advisor, Policy and Engagement

Francine St. Denis
U.S. Environmental Protection Agency
Office of International and Tribal Affairs
American Indian Environmental Office

Michael Stover
U.S. Environmental Protection Agency
Region 1

Kai Tang
U.S. Environmental Protection Agency
Region 2

Christopher Taylor
U.S. Environmental Protection Agency
Region 7

Dawn Taylor
U.S. Environmental Protection Agency
Region 4

Katie Tiger
Eastern Band of Cherokee Indians (Region 4)

Chau Vu
U.S. Environmental Protection Agency
Region 1

Alexis Wagner
Metlakatla Indian Community (Region 10—Alaska)

Joe Williams
U.S. Environmental Protection Agency
Office of Research and Development

Tribal Consultation Participants

Dianne Barton (via teleconference)
Columbia River Inter-Tribal Fish Commission

Kara Berst (via webinar)
Chickasaw Nation

Christopher Impellitteri (via teleconference)
U.S. Environmental Protection Agency
Office of Research and Development

Shaun Livermore (via teleconference)
National Tribal Water Council

Jeremy Pitka (via teleconference)
Native Village in Alaska

Alex Ratcliff (via webinar)
Southern Ute Indian Tribe

Mary Ross (via teleconference)
U.S. Environmental Protection Agency
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Michael Slimak (via teleconference)
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